

FEI-010-2012

FUTURE FISHERIES IMPROVEMENT PROGRAM
GRANT APPLICATION
(please fill in the highlighted areas)

I. APPLICANT INFORMATION

A. Applicant Name: Ueland Ranches, Inc. (Don and Dan Ueland)

B. Mailing Address: 100 Cattle Drive

C. City: Ramsay State: MT Zip: 59748

Telephone: 782-1123 or 491-7342 (Don)

D. Contact Person: Will McDowell, Project Coordinator

Address if different from Applicant: WRC 1002 Hollenback Rd.

City: Deer Lodge State: MT Zip: 59722

Telephone: 406-396-7716 (Cell)

E. Landowner and/or Lessee Name
(if other than Applicant):

City:

Telephone:
Landowner

PROJECT INFORMATION*

A. Project Name: Ueland Prevost Road Channel Reconstruction

River, stream, or lake: Browns Gulch tributary to Silver Bow Creek

Location: Township 3N Range 8W Section 6,7

County: Silver Bow

B. Purpose of Project:

Improve aquatic habitat and water quality for native fish and sport fish in a critical reach of Browns Gulch, the largest tributary to the newly restored Silver Bow Creek.

C. Brief Project Description:

The project will reconstruct 1,400 feet of stream channel which was historically channelized along the perimeter of a hayfield. The site is currently experiencing massive bank erosion, which is contributing huge quantities of fine sediment (270 tons/mile/year) to the lower five miles of Browns Gulch, degrading water quality and habitat (see graphs and photos).

This project grows out of a diagnostic study of sediment supply done by WRC and Mile High Conservation District in 2011. That study, executed by Pioneer Technical, Inc. with sub-contractors Tom Wesche (fisheries biologist at U. Wyoming) and Karin Boyd (geomorphologist), concluded that: 1) fine sediment is the primary limiting factor on aquatic habitat in Browns Gulch, and 2) the primary source of fine sediment is eroding stream banks, particularly in historically channelized reaches; 3) reconstruction and management of certain carefully-selected stream channel segments could dramatically reduce sediment supply and benefit the fishery. This reach was one of two high-priority reaches where Bank Erosion Hazard Index data indicated that sediment yield was an order of magnitude higher than the rest of Browns Gulch sites.

The project consists of replacing 800 feet of channelized, deeply incised stream with 1,400 feet of a Rosgen E-type meandering stream channel using natural channel construction techniques and largely local materials, including sod mats, coir-wrapped sod, juniper brush, willow stakes and gravel. This project will allow the stream to regain access to its floodplain, restore natural geomorphic processes, and re-establish native woody and wetland vegetation to stabilize the channel banks and floodplain. The old straightened channel will be filled in and revegetated. The site will be fenced with electric fence to permit full recovery of native vegetation and banks before any livestock grazing will be resumed. Landowners will prepare a grazing plan which supports long-term recovery of the site.

Browns Gulch is the largest tributary of Silver Bow Creek, and is a Tier 1 fishery restoration priority for Montana FWP in the Upper Clark Fork. Recent fish tagging by Montana Fish Wildlife and Parks has documented that large fluvial westslope cutthroat trout, now present in Silver Bow Creek after decades of absence, are exploring the lower reaches of Browns Gulch. There is also a resident population of westslope cutthroat trout, as well as western pearlshell mussels, in middle and upper Browns Gulch. Browns Gulch aquatic habitat is degraded by seasonal dewatering, fine sediment, and poor riparian habitat conditions. This project is a pilot effort to improve habitat, in coordination with fish passage projects (ladders already funded), to promote seasonal reconnection of the native fishery in the middle watershed with the native fishery in Silver Bow Creek. This project is located strategically above the majority of the large irrigation diversions on Browns Gulch, which tend to dewater the lower three to four miles of the stream in dry years, and maintains good streamflows (WRC has daily flow data here and in the lower Gulch).

It is the intention of this project to support the reconnection of the new Silver Bow Creek native trout population to potential spawning and rearing areas in upper Browns Gulch, and improve habitat for native fish and sport in critical reaches where habitat is presently being degrading by high sediment supply. .

This project is part of a larger partnership effort: the Watershed Restoration Coalition is working on with Trout Unlimited, the Mile High Conservation District, Clark Fork Coalition, Butte Silver Bow government, NRCS, NRD and landowners to improve water quality and fish habitat in middle and lower Browns Gulch. Match funding is already secured.

D. Length of stream or size of lake that will be treated: **Browns Gulch is 15 miles long**

E. Project Budget:

Grant Request (Dollars): \$ 29,960

Contribution by Applicant (Dollars): \$ [REDACTED] In-kind \$ 15,640
(salaries of government employees are not considered as matching contributions)

Contribution from other Sources (Dollars): \$ 43,200 In-kind \$ 9,325
(attach verification - See page 2 budget template)

Total Project Cost: \$ 98,185

- F. Attach itemized (line item) budget – see template
- G. Attach specific project plans, detailed sketches, plan views, photographs, maps, evidence of landowner consent, evidence of public support, and/or other information necessary to evaluate the merits of the project. If project involves water leasing or water salvage complete supplemental questionnaire (fwp.mt.gov/habitat/futurefisheries/supplement2.doc).
- H. Attach land management and maintenance plans that will ensure protection of the reclaimed area.

III. PROJECT BENEFITS*

- A. What species of fish will benefit from this project?:

The project is intended to benefit pure westslope cutthroat trout and brook trout. Fluvial cutthroat trout have recolonized Silver Bow Creek (from German Gulch) over the last three to four years. Some of these fish are exploring habitat in Browns Gulch. The primary objective of the project is to improve degraded habitat between Silver Bow Creek and the middle/upper Browns Gulch sites which have existing westslope cutthroat spawning/rearing habitat (used by resident cutthroats).

- B. How will the project protect or enhance wild fish habitat?:

The project will enhance wild fish habitat by removing a large source of fine sediment to lower Browns Gulch. We believe this is a necessary step in helping native cutthroat trout now colonizing Silver Bow Creek to expand their habitat into lower and middle Browns Gulch, and re-establish a connection with higher quality habitats in upper Browns Gulch. Higher quality habitat may also benefit the resident brook trout fishery in this area.

- C. Will the project improve fish populations and/or fishing? To what extent?:

It is expected that the project will improve fish populations by dramatically reducing sediment supply, thereby improving habitat in lower Browns Gulch. This may enhance potential for seasonal movement of fluvial cutthroats between upper Browns Gulch and Silver Bow Creek, in combination with fish passage measures already underway. It will also improve resident fish populations by improving substrate, shade, depth of pools and other habitat features in the project reach, making that habitat more attractive to native fish relative to degraded sites.

- D. Will the project increase public fishing opportunity for wild fish and, if so, how?:

Browns Gulch currently has a brook trout fishery, which includes some large specimens, particularly in reaches with beaver ponds. The project will dramatically increase fishing opportunities if wild cutthroats begin to consistently use lower and middle reaches of Browns Gulch as migratory and rearing habitat, which would diversify the brook trout fishery.

- E. If the project requires maintenance, what is your time commitment to this project?:

The WRC is working with TU, Clark Fork Coalition, Mile High Conservation District, DEQ, and NRPD in a Browns Gulch working group, meeting on the same day and place as the Mile High Conservation District, to track progress on implementation, effectiveness and eventually maintenance needs on all the project components. The WRC and landowners are committed to the success of this restoration site and the improvement of Browns Gulch for the long-term.

F. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?:

Habitat degradation in Browns Gulch is a direct result of channel manipulation (straightening and incision), historical overgrowth of woody riparian vegetation, and constriction of the stream corridor from upstream sedimentation caused the stream to relocate through adjacent hayfields. The project is directly correcting the channel manipulation by bank stabilization, re-establishing stable plan and profile, re-vegetating with woody shrubs, and installing fencing and water gaps to widen the riparian corridor and control livestock impact.

G. What public benefits will be realized from this project?:

Public benefits will include: improvement of native fish populations on private and public land (the upper end of Browns Gulch is mostly US Forest Service), reduction of excess sediment supply to Browns Gulch and Silver Bow Creek, and improvement in water quality and fish habitat in two priority drainages (both lower Browns Gulch and Silver Bow Creek).

H. Will the project interfere with water or property rights of adjacent landowners? (explain):

No water rights will be negatively affected.

I. Will the project result in the development of commercial recreational use on the site?: (explain):

No, this is a commercial livestock ranching operation.

J. Is this project associated with the reclamation of past mining activity?:

No mining activity is directly related to the project, but there are indirect benefits to the remediated and restored Silver Bow Creek, by improving habitat connectivity.

Each approved project sponsor must enter into a written agreement with the Department specifying terms and duration of the project.

IV. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature:



Date:

11/09/13

Sponsor (if applicable):

*Highlighted boxes will automatically expand.

Mail To:
Montana Fish, Wildlife & Parks
Habitat Protection Bureau
PO Box 200701
Helena, MT 59620-0701

Incomplete or late applications will be returned to applicant.

Applications may be rejected if this form is modified.

*****Applications may be submitted at anytime, but must be received by the Future Fisheries Program office in Helena before December 1 and June 1 of each year to be considered for the subsequent funding period.*****

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS
 (Revised 11/27/2013)

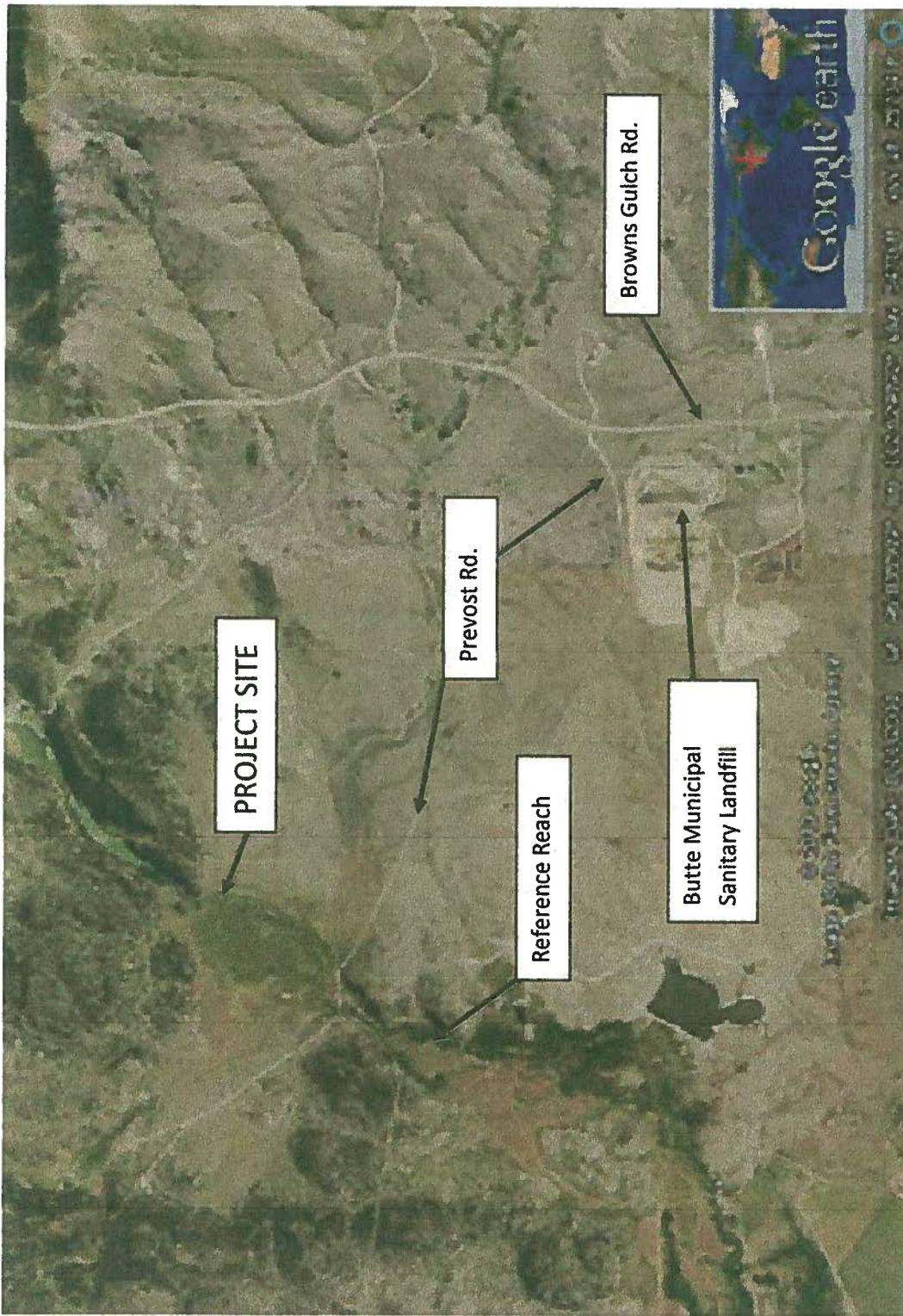
WORK ITEMS (ITEMIZE BY CATEGORY)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	CONTRIBUTIONS		
					FISHERIES REQUEST	IN-KIND SERVICES	IN-KIND CASH
Personnel							
Survey	2	days	450	900			\$ 900.00
Design (geomorphic for channels)		days	800	0			\$ -
Engineering	4	days	800	3200			\$ 3,200.00
Permitting	3	days	400	1200			\$ 1,200.00
Oversight (\$800/day to \$400/day)	15	days	600	9000	1600	2800	\$ 9,000.00
Labor (provided by contractor)	30	days	160	4800			\$ 4,800.00
Admin and Project Mgmt		5 percent		4000	4500		\$ 4,500.00
Travel							
Mileage	1000	miles	0.565	565	0	825	\$ 825.00
Per diem							\$ -
Construction Materials							
Ueland Prevost Rd. channel							\$ -
ESTIMATE build channel/floodplain	1400	per ft.	55	77000	0		\$ -
INCLUDES MATERIALS & EQIP							\$ -
Stream bed washed gravel	300	yds	14	4200			\$ -
Pit run gravel (brush toe)	250	yds	14	3500			\$ -
Floodplain sand/gravel	50	yds	14	700			\$ -
Willow stems, locally cut	5000	stems	0.2	1000			\$ -
Junipers, locally cut brush toes/flood	330	trees	2	660	660		\$ 660.00
Dekowe 700 Coir fabric (net)	8	165 ft. rolls	350	2800			\$ -
2x4 stakes	1000	stakes	1	1000			\$ -
Preveg coir mats w/ sedges	13	6x16 ft mat	200	2600			\$ -
Seed	25	lbs.	20	500			\$ -
Containerized plants w/ protection	100	2-yr old	\$12.00	\$ 1,200.00			
Electric fence (installed)	2000	ft.	1.2	2400			\$ 20,560.00
SUBTOTAL				20560	20560	15040	\$ 15,040.00
Old channel fill	1880	yds	8				
Equipment							
Trakhoe, large	15	days	1,200	18000			\$ -
Bobcat	15	days	500	7500			\$ -
Dump truck/trak truck	15	days	600	9000			\$ -
SUBTOTAL				34500	34500	34,500	\$ 34,500.00
Mobilization	1	site	3000	3000			\$ 3,000.00
Mobilization							\$ -
TOTALS:	Pages 1 of 2		\$ 29,960.00	\$ 25,025.00	\$ 43,200.00		\$ 98,186.00

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS
(Revised 11/27/2013)

*Units = feet, hours, inches, lump sum, etc.

MATCHING CONTRIBUTIONS

CONTRIBUTOR	IN-KIND SERVICE	IN-KIND CASH	TOTAL
Montana 319 DEQ	\$ -	\$ 43,200.00	\$ 43,200.00
WRC	\$ 9,325.00	\$ -	\$ 9,325.00
Landowners	\$ 15,700.00	\$ -	\$ 15,700.00
	\$ -	\$ -	\$ -
	\$ -	\$ -	\$ -
	\$ -	\$ -	\$ -
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	\$ -	\$ -	\$ -
	\$ -	\$ -	\$ -
TOTAL:	\$ 25,025.00	\$ 43,200.00	\$ 68,225.00



LOCATION MAP FOR UELAND RANCHES PREVOST RD. CHANNEL RECONSTRUCTION. Sec. 6, T3N, R8W NEAR ROCKER, MT

DIRECTIONS: From I-90 north exit at Rocker, take Browns Gulch Rd. north. Turn left on Prevost Rd. on north side of Municipal landfill. Follow Prevost Rd. west to the Browns Gulch bridge culvert. Project is north through pasture along creek.



Typical site photos: BG-17 Prevost Rd. meadow, Browns Gulch (Ueland Ranches)



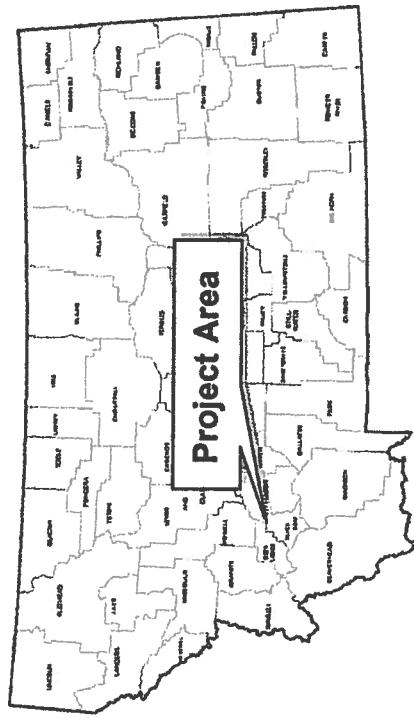
Comparison of Prevost Rd. channel plan form design with an existing “reference” reach of Browns Gulch less than one mile downstream. Characteristics of the new channel estimated from this reach, which rated very highly in an NRCS riparian assessment.

UR RANCH PHASE I
BROWNS GULCH RESTORATION

LOCATED IN SECTION 6, TOWNSHIP 3N, RANGE 8W
LATITUDE = 46.0396 NORTH; LONGITUDE = 112.6350 WEST
SILVER BOW COUNTY, MONTANA

OWNER: UR RANCH
COOPERATING PARTNERS: WATERSHED RESTORATION COALITION

OCTOBER 29, 2013



2011 N.A.I.P. AERIAL IMAGE

KC HARVEY ENVIRONMENTAL, LLC	PROJECT DRAFTER DRAWING COORD.	VICINITY MAP & SHEET INDEX BROWNS GULCH RESTORATION - UELAND PHASE 1	RESTORATION DESIGN PLAN
			SHEET 1

SHEET INDEX:

- SHEET 1 VICINITY MAP & SHEET INDEX
- SHEET 2 SPECIFICATIONS
- SHEET 3 EXISTING PLAN AND LONGITUDINAL PROFILE
- SHEET 4 DESIGN PLAN & PROFILE
- SHEET 5 PLAN VIEW WITH EXISTING & PROPOSED ELEMENTS
- SHEET 6 CROSS SECTIONS 1 - 6
- SHEET 7 CROSS SECTIONS 7 - 11
- SHEET 8 CROSS SECTION & BANK CONSTRUCTION DETAIL
- SHEET 9 TYPICAL CHANNEL BANK AND BED TREATMENTS AND VALLEY SECTION VIEW
- SHEET 10 FLOODPLAIN REVEGETATION AND HYDRAULIC ROUGHNESS
- SHEET 11 CHANNEL LONGITUDINAL PROFILE DETAIL

GENERAL NOTES:

Crestline height ~ 1 FT

Vertical Datum: NAVD88

Horizontal Datum: NAD83

Project Description: The project is intended to re-establish floodplain connectivity and create stable, channelized stream in plan, profile and cross section. A new channel will be constructed on a historic floodplain surface adjacent to the existing entrenched channel. This channel relocation phase of the project will move the existing channel just downstream of an irrigation ditch near existing channel stations 08+6. The project will tie back into the existing channel near existing channel station 08+10 at a minor headcut grade control. Upon project completion stream flows will be diverted into the new channel and the existing channel will be removed.

WORKMANSHIP:

Workmanship will be of paramount importance and while restoration of stream function is the top priority, the project is also intended to be visually similar to more naturalized stream reaches within the drainage.

GENERAL SPECIFICATIONS:

It shall be the contractor's responsibility to construct the project to these specifications, the plan set, and special conditions outlined in project records. Work shall consist of furnishing all equipment, materials, and labor performing all operations in connection with the GR Ranch Phase I Brown's Gulch Restoration. The contractor shall notify the project manager of any conflict between the specifications, plans and permit conditions prior to implementation. The project manager will be KC Harvey Environmental, LLC. The Client is the Watercolor Restoration Coalition (WRC).

All work shall be in accordance with safety requirements of Occupational Safety and Health Administration (OSHA), Safety and Health Regulations, Part 1926, Safety and Health Requirements for Construction, Subpart P, Excavations.

EQUIPMENT:

The contractor shall furnish all equipment necessary to construct the project. Type and size of equipment will be at the discretion of the contractor provided that it can be safely transported to the site without causing damage to access roads and bridges or other private or public property.

All equipment shall be power washed prior to mobilization to the site to minimize the introduction of noxious plants and aquatic life species. Equipment shall be free of oil, hydraulic fluid, and diesel fuel leaks.

Equipment shall be well maintained throughout the term of the project to reduce the risk of fluid leaks during construction. The contractor shall have fluent spill containment equipment present at the job site at all times. If a spill occurs contractor shall immediately notify the Project Manager.

Costs incurred as a result of equipment breakdown shall be at the expense of the contractor.

PRECONSTRUCTION SUBMITTALS:

Prior to construction the Contractor shall submit to the Client for review the following:

- 1) A sample of the contractor's proposed implement used

Contractor shall submit a photograph and a graduation electronically as .pdf files to the Project Manager

(tunlemon@harvey.com) and the Client (will@watercolor.org).

CONSTRUCTION STAKING:

The Project Manager will provide initial staking of key project features. The Contractor is responsible for re-staking of disturbed stakes. Wooden stakes and lath for reference staking will be labeled with the appropriate information (station, offset, elevation, location, etc.). Plastic flagging will be brightly colored or fluorescent plastic ribbon securely tied to the survey stake. Plastic flagging that becomes faded, torn, or dislodged shall be replaced at the Contractor's expense. Paint, when used in lieu of plastic flagging to mark survey stakes, shall be brightly colored or fluorescent in order to be visible from passing equipment.

Placed brush may protrude from the bank face into the pool area as much as 10% of the channel top width. When sufficient brush or available tree banks may be constructed to a nearly vertical angle but should have a finished 1:1 bank profile or stepped. All bank's shall be constructed such that a stable platform for sed upper bank construction can be executed.

Horizontal Stakes: Horizontal stakes marking the location of the new channel shall be placed along the centerline and at right angles to the centerline. Transitions between stakes demarking channel features shall occur smoothly; Sharp transitions and straight lines shall be avoided.

To the maximum extent possible, and shall be surveyed, borders transected and placed immediately in one operation. The soil shall be tamped in place to ensure complete contact with the pool material. Frozen soil shall not be placed, nor shall soil be placed on frozen ground unless the ground surface is tamped and enables firm soil to ground surface contact. Soil shall be placed to cover the entire required surface a tamped, solid or loose and, ramming edges that would likely be dislodged by flowing water. Any loose soil shall be panned or staked to the base materials with wood stakes or other approved methods.

At numerous locations within the project work area, the designed stream channel approaches nature a willow clusters with willow-leaf riparian system. At these locations, the new stabilized bank zones shall be used as the finished channel bank. Soil and willow transplants shall be used to re-fit along these banks to achieve the finished bank height.

CHANNEL BED GRADING:

The finished channel bed shall be constructed as a ripraping, alternating series of shallow riffles and relatively deep pools. Each series begins at a stake or little control point (elevation), which corresponds to the shallowest point in the channel (top of riffle). From this point, the channel bed (rifflle) will slope on average 2 to 3 times that of the average slope of the channel. Average slope is measured between top of little elevations. At the bottom of a riffle, the channel bed increases rapidly in depth until the point of maximum pool depth. Downstream of channel banks is achieved. From the point of maximum pool depth, the channel bed will begin to gradually drop back up to the next little control elevation.

GRAVEL PLACEMENT:

Impenetrable gravel in the upgradient shown on Sheet 8 shall be placed on the sloping little portion of the streambed and in rock balls to a depth of at least 0.5 feet. Gravel shall be placed until the approximately 50% of the streambed is occupied by coarse particles larger than 1.5 inches in diameter. Coarse particle coverage of the streambed can be accomplished with the use of extra and materials, improved materials or a combination of the two.

REVEGETATION:

Revegetation of stream banks and floodplain surfaces will involve a variety of treatments using willow cuttings as described in the plan set. Cutting, bending and placement shall follow guidance outline in USDA Technical Note titled "A New Streambank Revetment Guide" and can be found online [here](#).

Cuttings for use in reinforced brush are treatments shall be a minimum of 3 feet in length with cuttings up to 8 feet in length will be replicated. Cuttings shall include a mix of live plants of all diameters and dead wood of a variety of species. Live cuttings shall provide from the front and backside of the bank construction to give cuttings an opportunity to grow and create a living bank.

Cuttings for use in floodplain treatments shall be a minimum of 4 feet in length. Planning sites shall be required by mechanically scalping soil from the planning site creating ungerminated soil of approximately 3 feet in width with varying depths from 5 to 15 feet. Willow stakes shall be installed with at least 50% of the cutting length function secondary as floodplain roughness elements and will retain debris during over bank flood events. Following installation of cuttings the excavated stakes shall be backfilled with non-cohesive sand or gravel to the floodplain elevation.

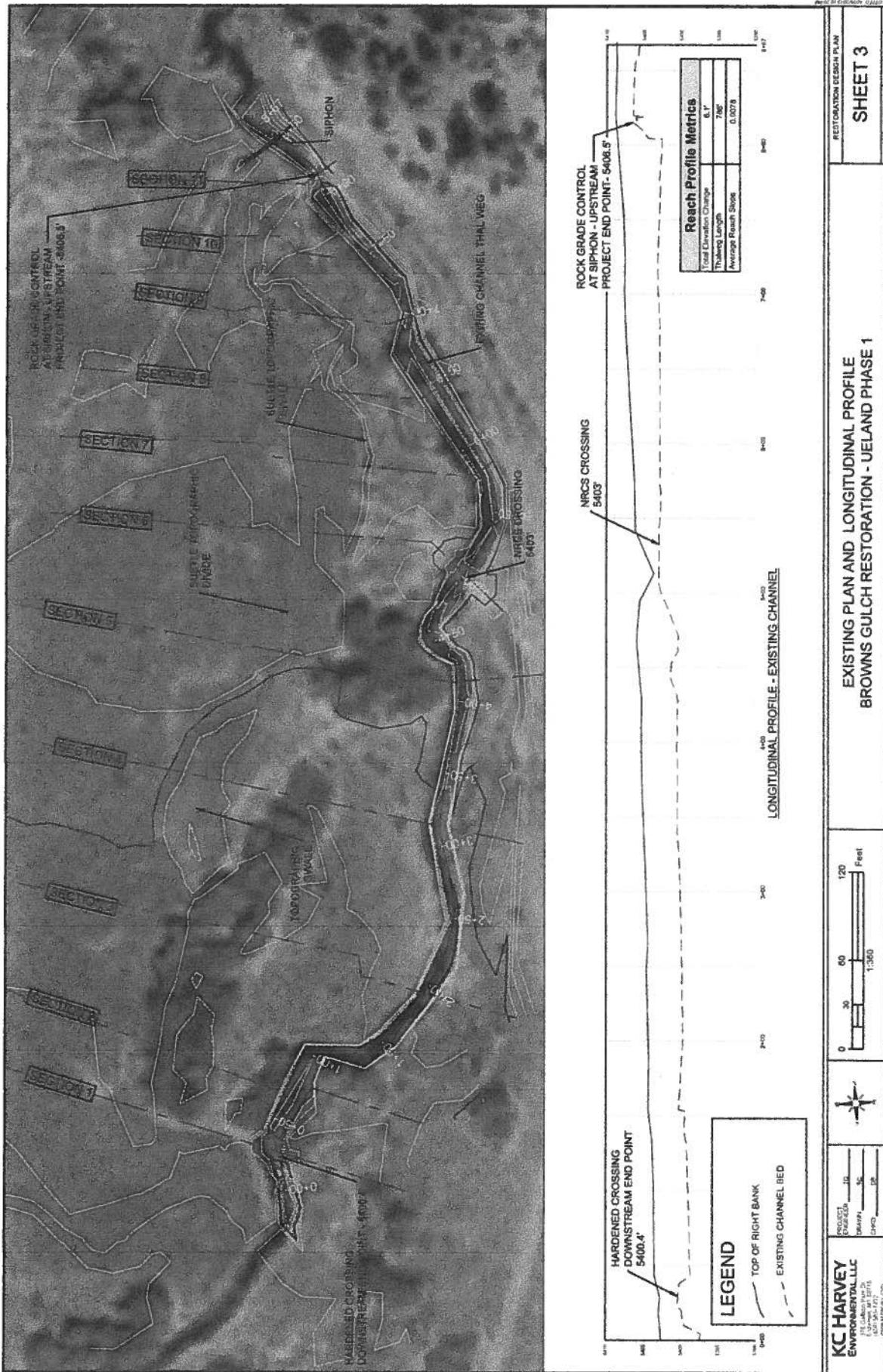
All live willow cuttings shall be completely submerged and soaked for at least two weeks prior to installation in bank and floodplain treatments.

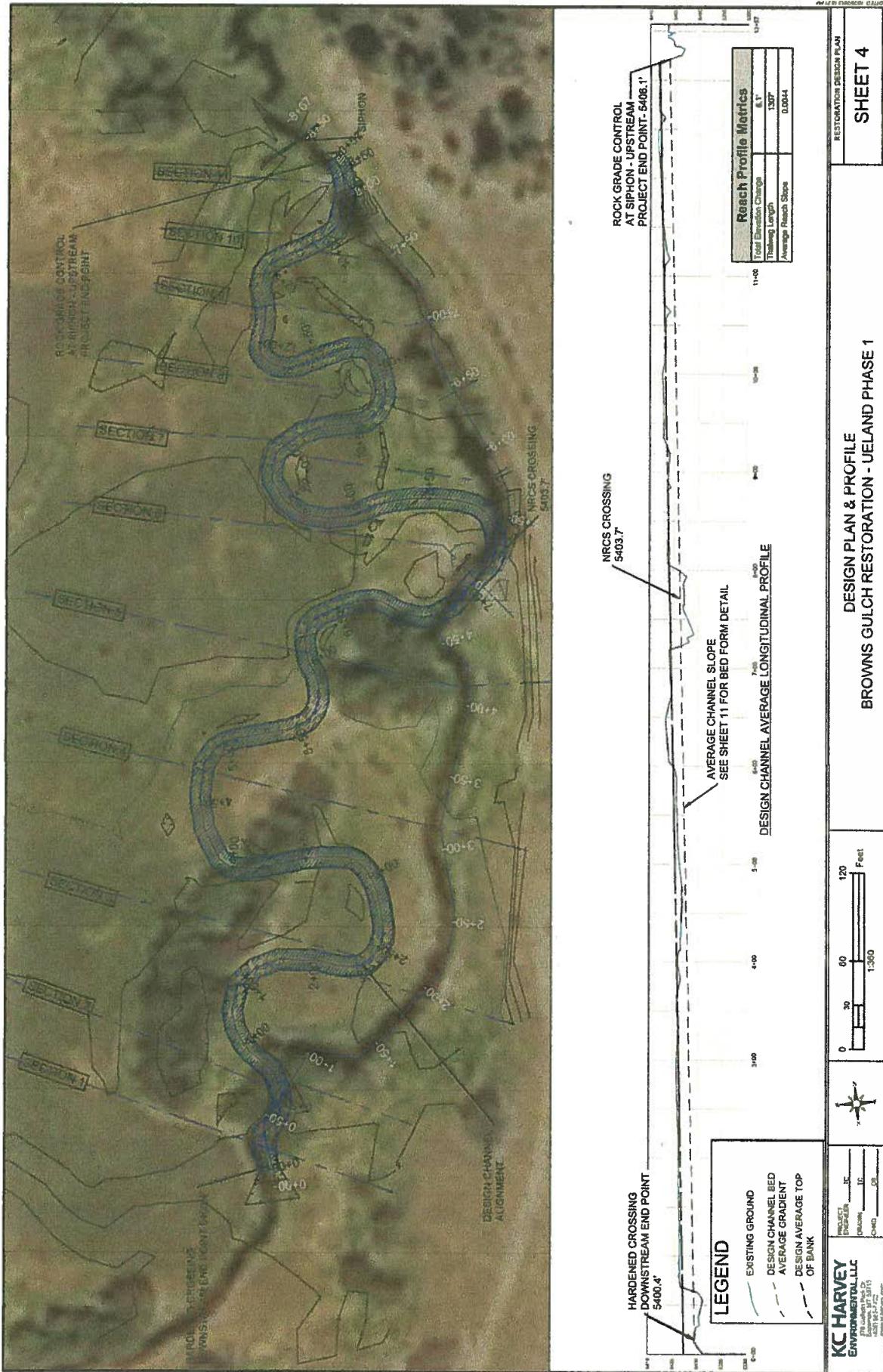
Reinforced brush is available at a given location. Long lengths may be used and should be embedded flush into the bank, beyond the over-excavation limit. After the sub-excavation is completed, a lift of brush shall be placed at random angles to the bank line so that the materials cross and interlock with each other. Livewoods shall be placed in a manner that at least 1/4 of the cutting profile is from the face of the bank or from the backside of the over-excavated limit. Upon completing brush placement, excavated stakes shall be placed and backfilled compacted to the the compaction alluvium. Tamped fill is firm and dry/drying. Additional brush lifts shall be placed until the desired low of bank height is achieved. Open compaction of the final lower bank, soil shall be placed to the finished bank height. On average 10 to 15 stems per linear foot shall be used to establish root tufts.

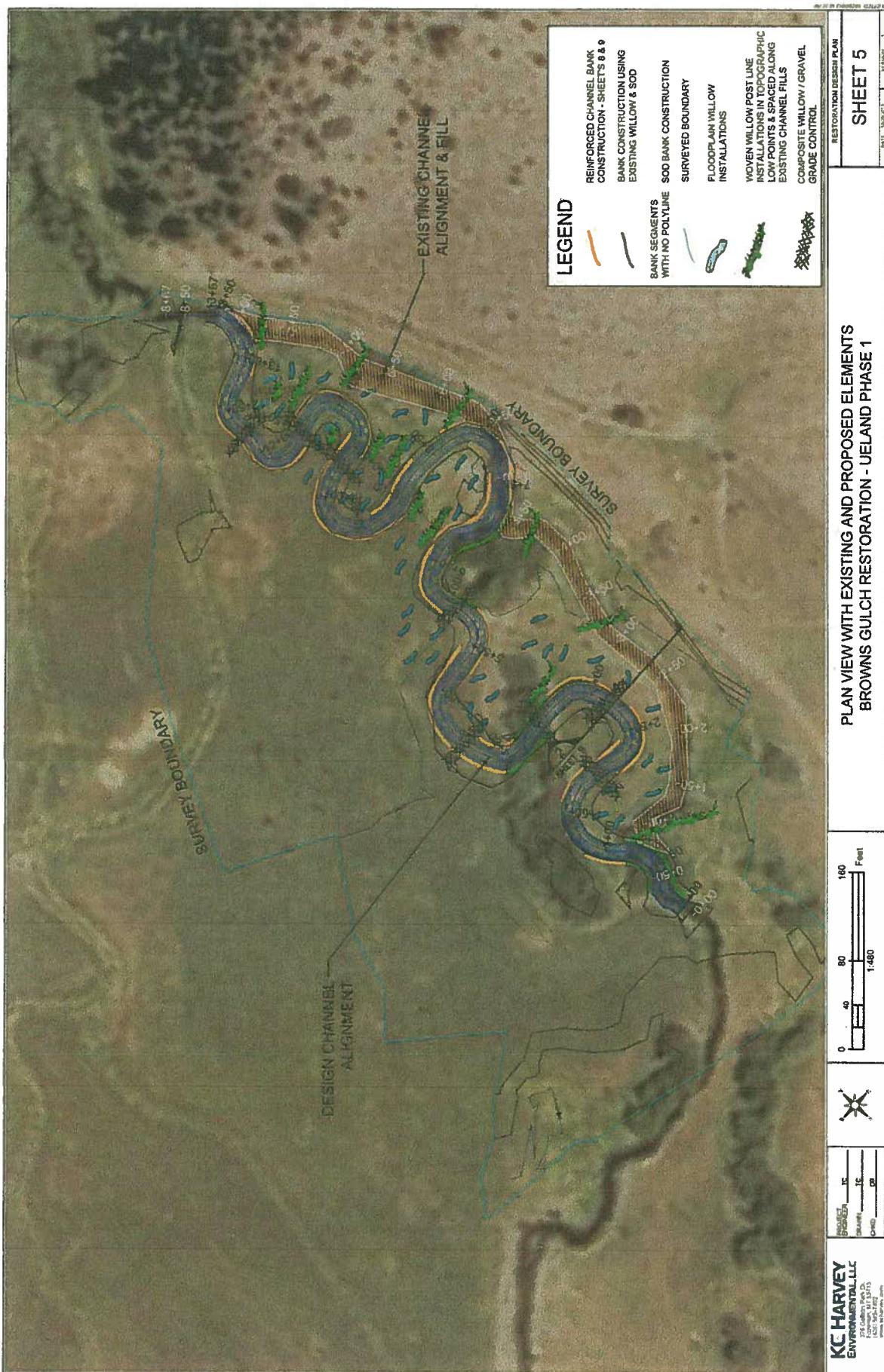
SPECIFICATIONS
BROWNS GULCH RESTORATION - UELAND PHASE 1

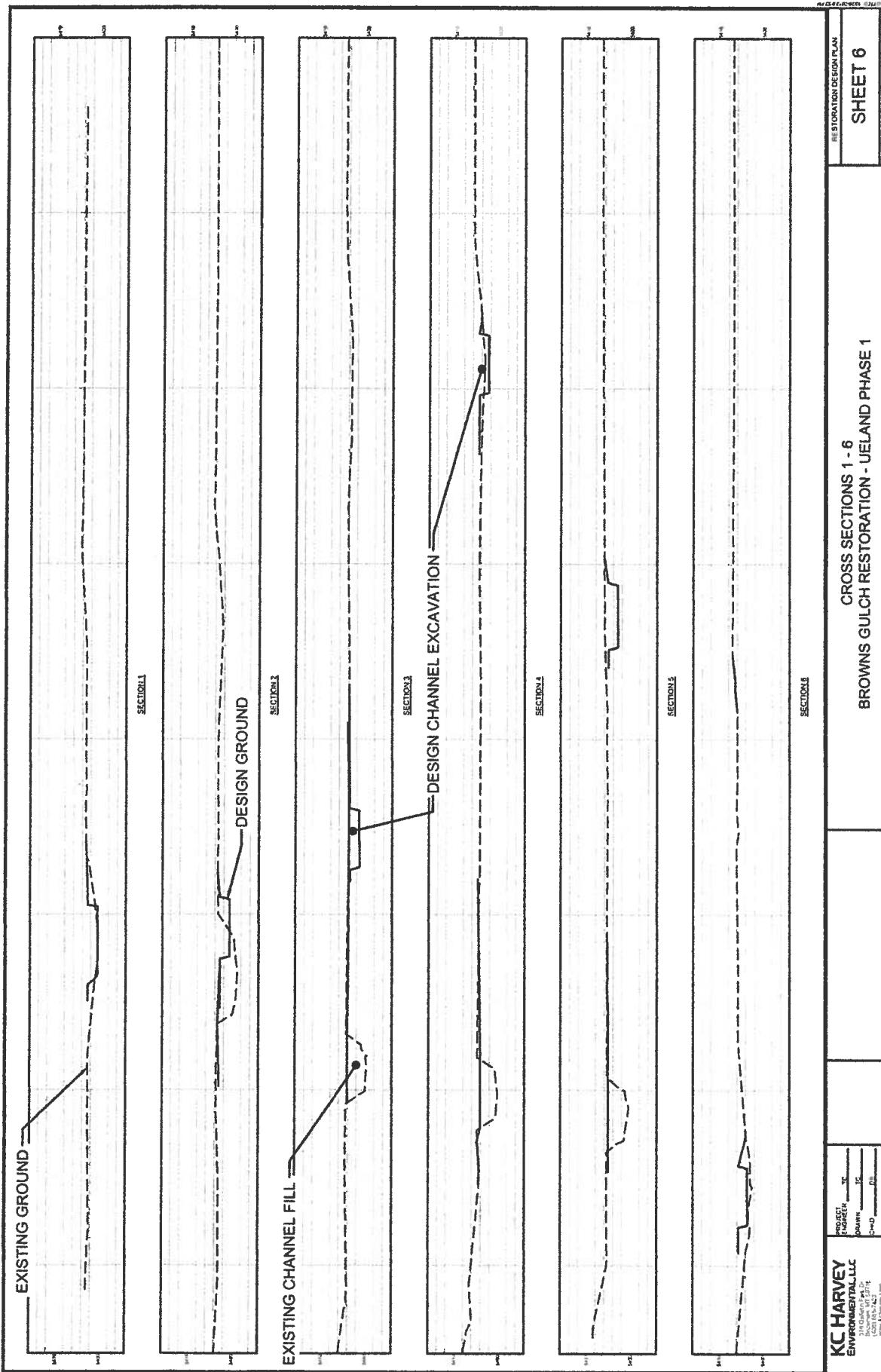
RESTORATION DESIGN PLAN
SHEET 2

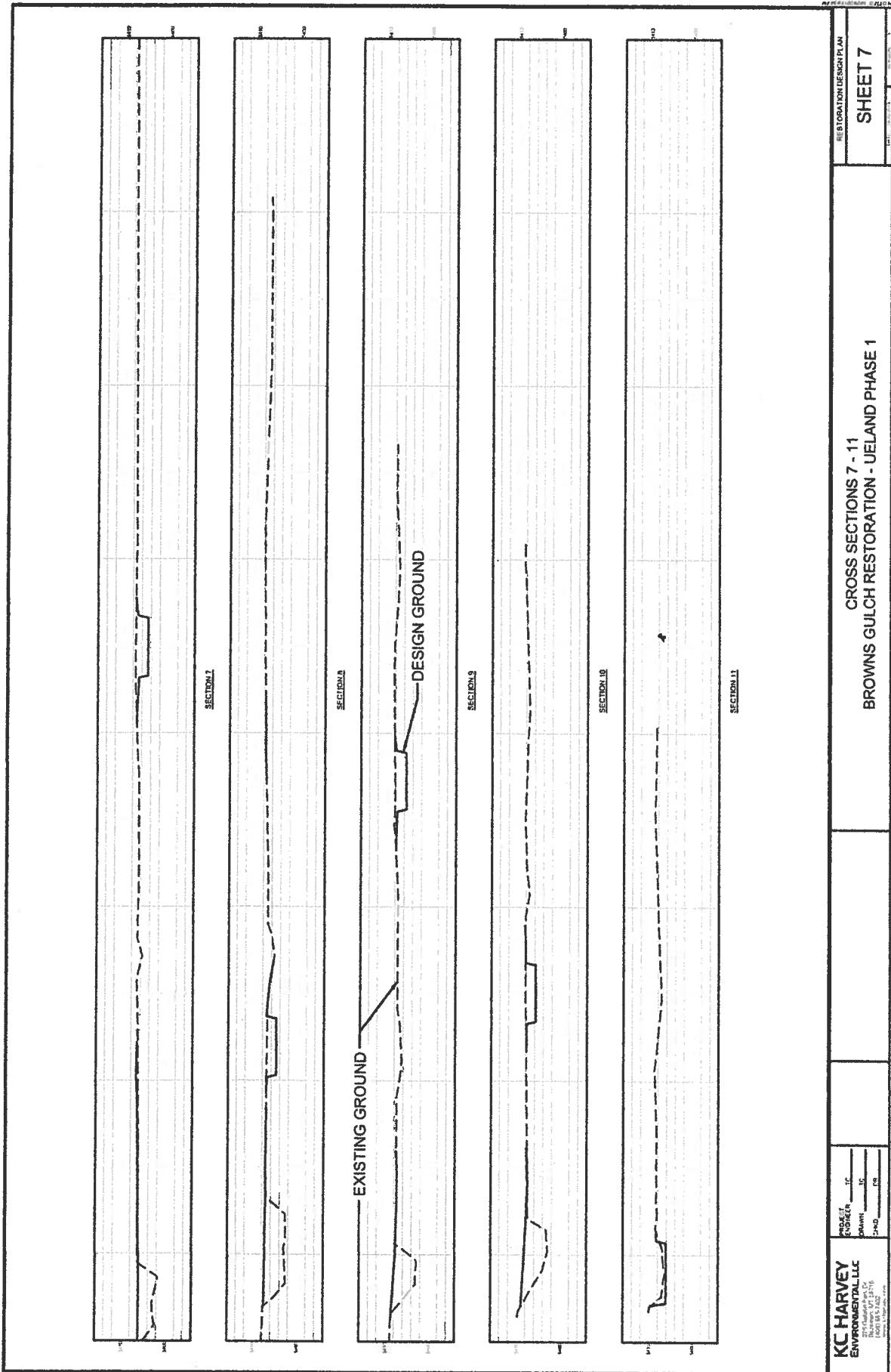
Project	Project Name	Project Number
Engineer	Engineer Name	Engineer Number
Reviewer	Reviewer Name	Reviewer Number









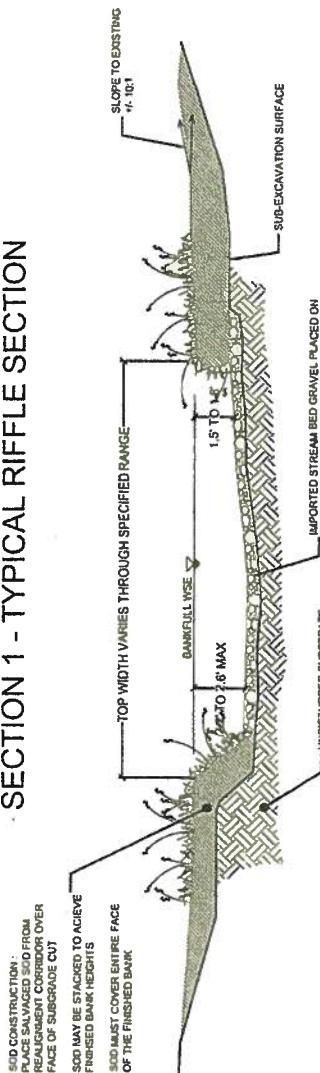


KC HARVEY
ENVIRONMENTAL LLC
1000 E. 12th Street
Boise, ID 83702
(208) 343-1111
(208) 343-1111
FAX: (208) 343-1111
E-mail: info@kc-harvey.com

CROSS SECTIONS 7 - 11
BROWNS GULCH RESTORATION - UELAND PHASE 1

RESTORATION DESIGN PLAN
SHEET 7

SECTION 1 - TYPICAL RIFFLE SECTION



PROPOSED CHANNEL METRICS

CHANNEL TOP WIDTH (FT)	12 TO 15
POOL DEPTH (MAX)	3.5 TO 4.0
AVERAGE RIFFLE DEPTH (FT)	1.8 TO 2.2
RIFFLE DEPTH (MAX)	2.2 TO 2.6
SLOPE (FT / FT)	0.0044

DESIGN CHANNEL CLASSIFICATION - E4

MATERIAL QUANTITIES

DESCRIPTION	QTY	UNITS
CHANNEL EXCAVATION	1630	BANK CUBIC YARDS (BCY)
WILLOW PLANTING SITE	50	BCY
EXISTING CHANNEL FILL	1630	COMPACTED CUBIC YARD (CCY)
IMPORTED STREAM BED GRAVEL (SEE GRADATION BELOW)	300	LOOSE CUBIC YARD (LCY)
IMPORTED BRUSH TOE RUN GRAVEL (4:6) = 2' x 3'	250	CCY
SAND / GRAVEL BACKFILL FOR FLOODPLAIN WILLOW PLANTINGS	50	LCY
WILLOW STEMS / BRUSH BANK TOES	2,000	STEMS
JUNIPER FOR BRUSH TOE BANKS AND FLOODPLAIN POST LINES	350	SMALL TREES
WILLOW CUTTINGS FOR FLOODPLAIN PLANTINGS	450	STEMS
DECOY TO COIR FABRIC (2 METER ROLLS)	8	ROLLS
2' X 4' STAKES	1000	PIECES
PRE-VEGETATED COIR MATS (16' LENGTHS)	13	PIECES

STREAM BED GRAVEL - PARTICLE SIZE DISTRIBUTION

PERCENT PASSING	DIA (mm)	DIA (in.)
100	76	3.0
50	38	1.5
30	19	0.8
MIN	7	0.3

NOTES:

ACCEPTABLE WOOD MATERIAL THAT MAY BE USED FOR BRUSH TOE BANK CONSTRUCTION INCLUDES ANY NON-NOTEN MATERIAL, RANGING FROM SMALL REBIELE STEMS TO LARGE BRANCHES OR TRUNKS UP TO 4 INCHES IN DIAMETER. LOCALLY AVAILABLE ADAPTERS MAY BE USED PROVIDED IT IS APPROPRIATELY TRIMMED OR MODIFIED TO ALLOW FOR COMPACTION OF BRUSH TOE.

BRUSH MAY PROTRUDE INTO THE POOL AREA FROM THE BANK FACE UP TO 10% OF THE CHANNEL TOP WIDTH.

BRUSH TOES SHALL BE CONSTRUCTED IN NO MORE THAN 1 FOOT LIFTS. IN EACH LIFT, BRUSH SHALL BE PLACED AND THEN BACKFILLED WITH EXCAVATED OR IMPORTED GRAVEL AND BUCKET COMPACTED UNTIL FIRM AND TIGHT. BRUSH TOE GRAVEL SHALL HAVE A DRAIN BETWEEN 2' TO 3' AND SHALL NOT BE WASHED.

WHERE CHANNEL APPROACHES MATURE WILLOW STANDS, THE EXISTING WILLOW ROOT SYSTEMS SHALL BE USED AS THE CHANNEL BARRIER TO THE EXTENT POSSIBLE. THESE BARRIERS CAN BE FURTHER FORTIFIED WITH SOD AND WILLOW TRANSPLANTS.

NOTE:

A RANGE OF DESIGN BANK HEIGHTS ARE SPECIFIED TO ALLOW THE CONSTRUCTED CHANNEL BANKS TO MATCH THE EXISTING GROUND HEIGHT. THIS WILL BE THE CASE AT MOST SITES ALONG THE CHANNEL ALIGNMENT IN THE EVENT THAT EXISTING GROUND ELEVATIONS FALL OUTSIDE OF THE DESIGN CHANNEL BANK RANGE. A FIVE FOOT BANK WIDTH AT THE DESIGN ELEVATION WILL BE CONSTRUCTED. AFTER WHICH THE GROUND WILL BE SLOPED AT 10:1 UNTIL THE CONSTRUCTED SURFACE MATCHES THE EXISTING GROUND.

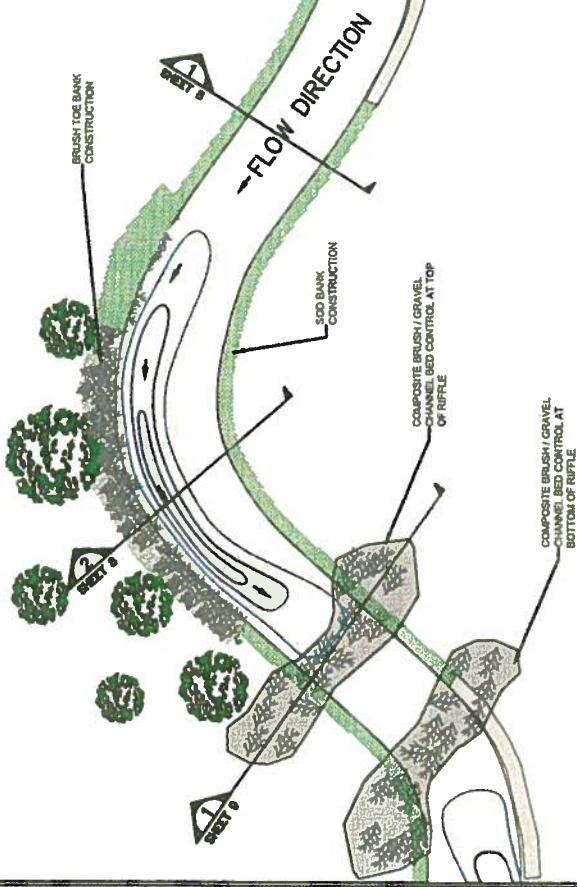
CROSS SECTION & BANK RESTORATION DETAIL BROWNS GULCH RESTORATION - UELAND PHASE 1

RESTORATION DESIGN PLAN

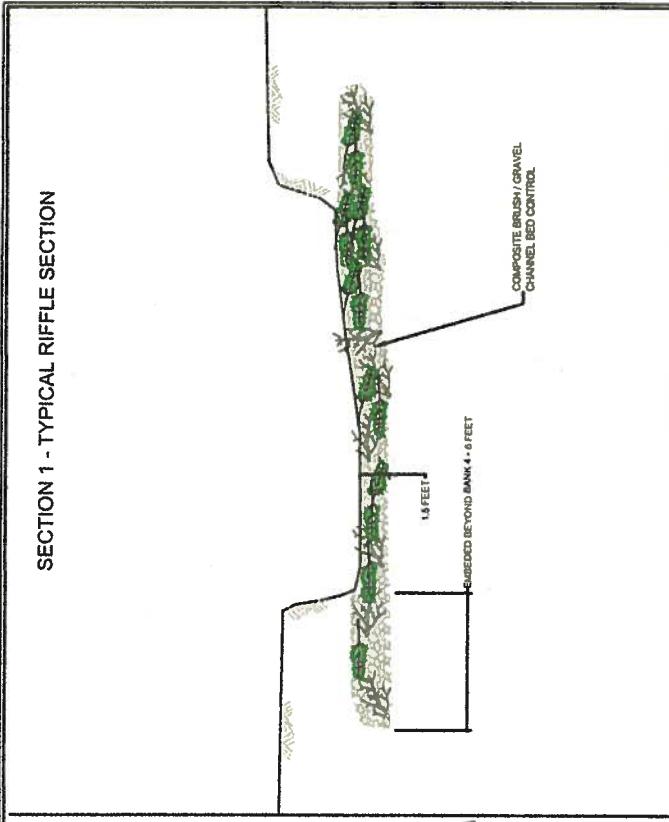
SHEET 8

KC HARVEY
ENVIRONMENTAL, LLC
201 California Street, Suite 15
Berkeley, CA 94710
(415) 843-1000
www.kcharvey.com

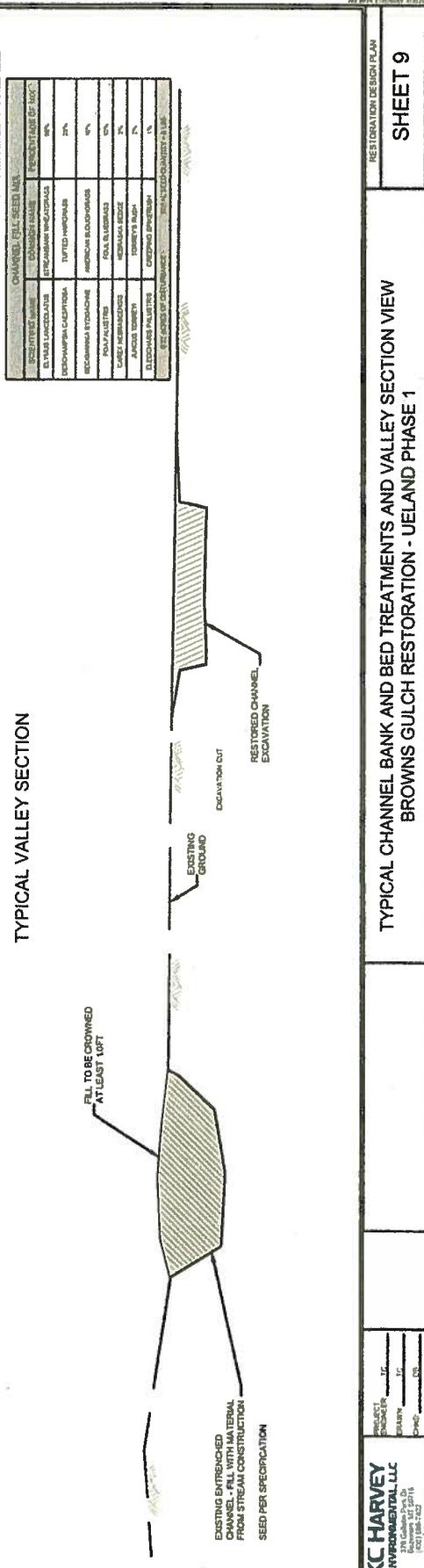
TYPICAL PLAN VIEW BANK AND CHANNEL BED TREATMENTS



SECTION 1 - TYPICAL RIFFLE SECTION



TYPICAL VALLEY SECTION

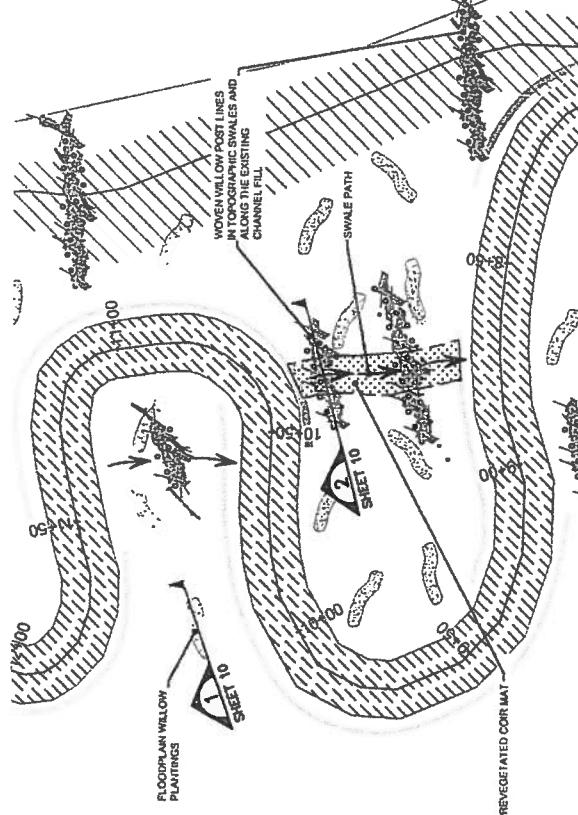


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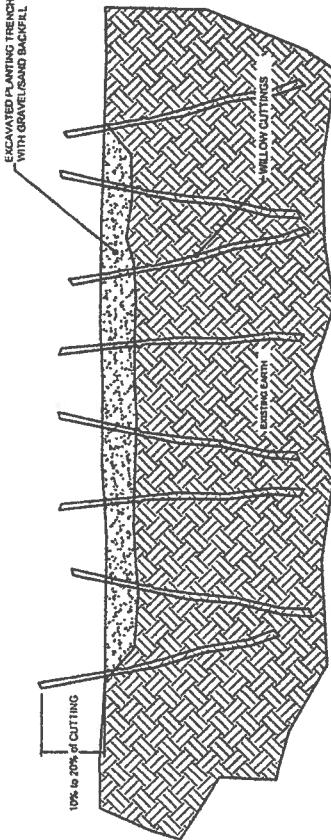
TYPICAL CHANNEL BANK AND BED TREATMENTS AND VALLEY SECTION VIEW
BROWNS GULCH RESTORATION - UELAND PHASE 1

RESTORATION DESIGN PLAN
SHEET 9

FLOODPLAIN REVEGETATION TREATMENTS - TYPICAL

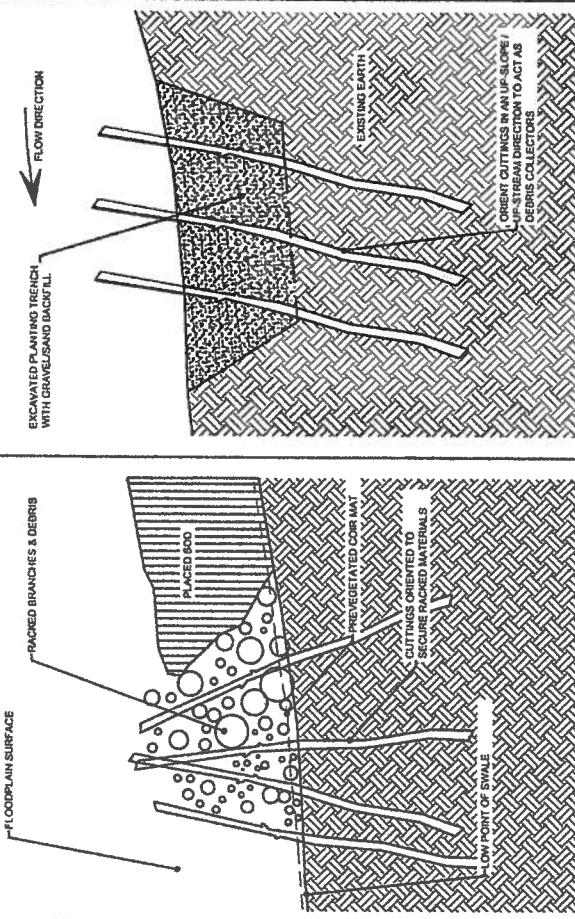


SECTION 1 - FLOODPLAIN WILLOW PLANTINGS



**FLOODPLAIN WILLOW PLANTINGS
IN CROSS SECTION**

WOVEN POST LINE IN CROSS SECTION

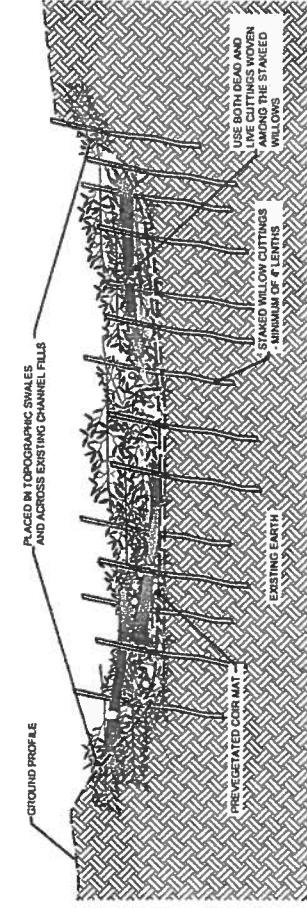


**FLOODPLAIN REVEGETATION AND HYDRAULIC ROUGHNESS
BROWNS GULCH RESTORATION - UELAND PHASE 1**

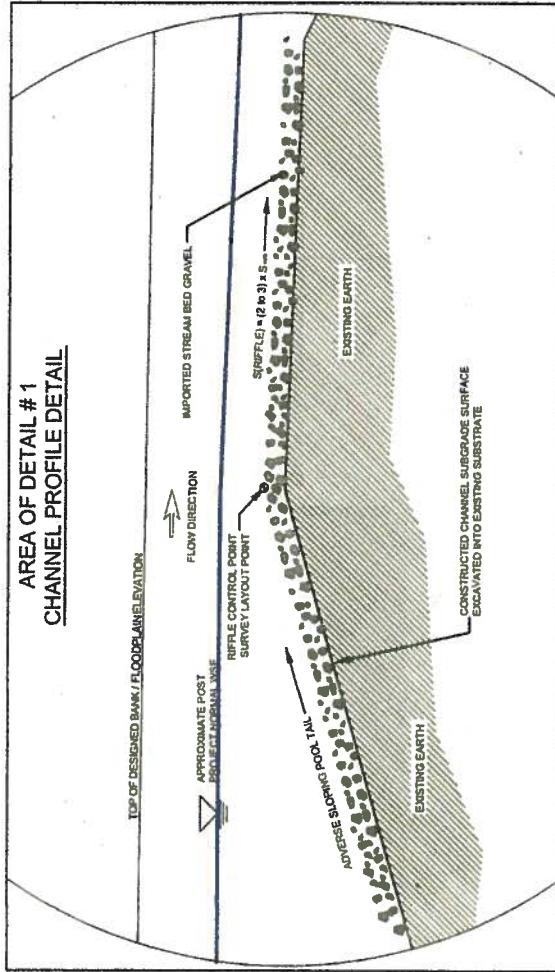
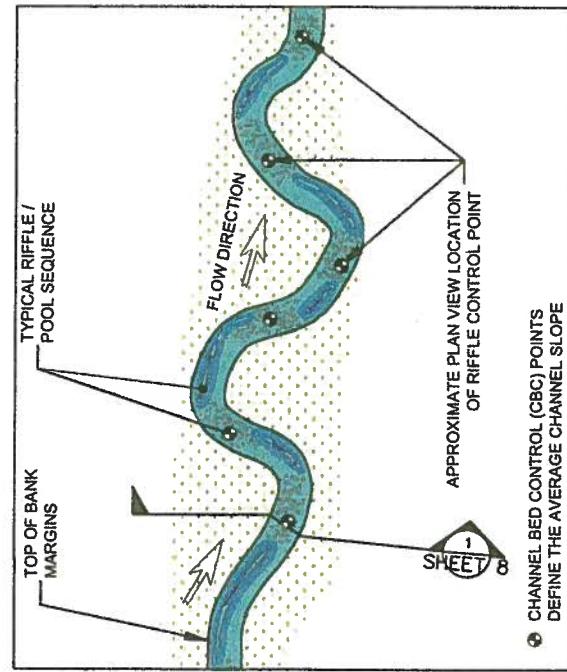
SHEET 10

RESTORATION DESIGN PLAN
DATE: 10/10/2011
SHEET: 10
PAGE: 10

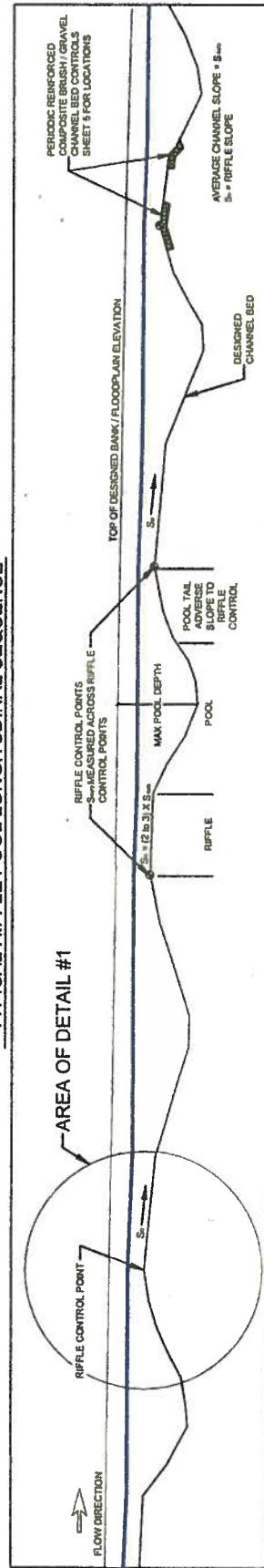
SECTION 2 - WOVEN WILLOW POST LINE FLOODPLAIN TREATMENTS



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TYPICAL RIFFLE POOL LONGITUDINAL SEQUENCE



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Project _____
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Page _____

CHANNEL LONGITUDINAL PROFILE DETAIL
BROWNS GULCH RESTORATION - UELAND PHASE 1

RESTORATION DESIGN PLAN
SHEET 11